

# Dell Shared PowerEdge RAID Controller (PERC) 8 For Dell PowerEdge VRTX Systems User's Guide

Regulatory Model: UCPM-800



# Notes, Cautions, and Warnings

 **NOTE:** A NOTE indicates important information that helps you make better use of your computer.

 **CAUTION:** A CAUTION indicates either potential damage to hardware or loss of data and tells you how to avoid the problem.

 **WARNING:** A WARNING indicates a potential for property damage, personal injury, or death.

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## About The Shared PERC 8 Card

The Dell Shared PowerEdge RAID Controller (PERC) 8 card installed on the Dell PowerEdge VRTX system supports Single Root Input Output Virtualization (SR-IOV). This feature allows multiple systems to share available hardware resources.

The PERC 8 card allows four server modules to access a local shared storage. Each server module's operating system loads a Virtual Function (VF) driver that allows the server module to communicate with the Shared PERC 8 firmware. The server module can then be mapped to either a single virtual disk or multiple virtual disks that are located on the shared storage. From a single server module, you can only access the virtual disks that are mapped to that server module.

## Configurations of the Shared PERC 8 card

The PowerEdge VRTX system is available in two configurations of the Shared PERC 8 card:

**Single Shared PERC 8 Card Configuration** — In this configuration, the PowerEdge VRTX system is installed with a single Shared PERC 8 card. The default cache policy for virtual disks created in this configuration is write-back. In this mode, write completion information is returned to the host after the data is written to the Shared PERC 8 controller's cache.

**Fault Tolerant Shared PERC 8 Card Configuration** — In this configuration, the PowerEdge VRTX system is installed with two Shared PERC 8 cards. The shared PERC cards are configured in an active-passive mode. Both the cards can access the storage subsystem. However, only the active controller will provide the data access. If one Shared PERC 8 card fails, the other Shared PERC 8 card takes control in a seamless transition.

Checkpoints are created for all background operations. After a failover, operations are restored from the last checkpoint. The default cache policy for virtual disks created in this configuration is write-back. In this mode, write completion information is returned to the host after the data is written to the peer shared PERC 8 controller's cache.

Host data is also mirrored to the peer controller's cache to allow seamless operation in case of a primary card failure.

Important information regarding the Fault Tolerant Shared PERC 8 Card Configuration:







- Multipath support must be enabled in the operating system for the Fault Tolerant Shared PERC 8 card configuration to function.
- In the event of a controller failover, a Background Initialization (BGI) starts automatically on each virtual disk.
- An ongoing full initialization does not restart in the event of a failover.


- Currently, Linux drivers do not support the fault tolerance feature of the PowerEdge VRTX system. Host servers running Linux are only supported in single-controller configuration.

## Specifications of a Shared PERC 8 card


The characteristics of a Shared PERC 8 card are as follows:

**Table 1. Shared PERC 8 card specifications**

Specification	Description
Supported drives	<p>Dell-qualified SAS hard drives and SAS solid state drives (SSDs). Mixing disks of different speeds (7,200 rpm, 10,000 rpm, or 15,000 rpm) and bandwidth (3 Gbps or 6 Gbps) while maintaining the same drive type (SAS) and technology (HDD or SSD) is supported. However, this may affect data transfer performance.</p> <p> <b>NOTE:</b> Mixing HDDs and SSDs within a virtual disk is not supported. SATA drives are not supported.</p>
RAID levels	<p>0, 1, 5, 6, 10, 50, and 60</p> <p> <b>NOTE:</b> Non-RAID drives are not supported.</p>
Virtual functions	Four virtual functions to support up to four host servers
Management application	<p>Dell Chassis Management Controller (CMC).</p> <p> <b>NOTE:</b> Option ROM (OP-ROM) is not supported. Booting from a shared storage is not supported. You can only boot from the storage located on the server module.</p>
Enclosure per port	Not applicable
Processor	Dell Adapter SAS RAID-on-Chip, 8-Port with LSI 2208 Chipset
Battery backup unit	Yes
Non-volatile cache	Yes
Cache memory	1 GB DDR3, 1333 MHz
Cache policies	<p>Write Back, Forced Write-Back, Write Through, Adaptive Read-Ahead, No Read-Ahead, and Read Ahead</p> <p> <b>NOTE:</b> Note that write-back caching in a dual controller configuration is not supported on the earlier versions of the Shared PERC 8 solution.</p> <p> <b>NOTE:</b> For the Shared PERC 8 card to support write-back feature, ensure that you download the updated firmware and driver version available at <a href="http://dell.com/support/home">dell.com/support/home</a>.</p> <p> <b>NOTE:</b> For more information, see the <i>PowerEdge VRTX Storage Subsystem Compatibility Matrix</i> at <a href="http://dell.com/support/home">dell.com/support/home</a>.</p>

Specification	Description
Maximum number of spans per disk group	8
Maximum number of virtual disks per disk group	16
Maximum number of virtual disks	64
Dedicated and global hot spares	Yes
Hot swap devices supported	Yes
Hardware XOR engine	Yes
Virtual disk initialization; background, full, and fast	Yes
Consistency check	Yes
Disk roaming	Yes
FastPath	Yes
Virtual disk migration between two Shared PERC 8 cards	Yes
	 <b>NOTE:</b> The target Shared PERC 8 card firmware level must be either higher or equal to the source Shared PERC 8 card firmware level.
Virtual disk migration from PERC H310, H710, or H710P cards to a Shared PERC 8 card	No
SMART detection	Yes
Patrol Read	Yes
Automatic replace member	Yes
SAS (HDD/SSD) hard drive	Yes
Physical disk power management	IDLE-C for compliant HDDs only. No support for balanced, maximum, and customized power savings.
SATA (HDD/SSD) hard drive	No
Manual replace member	No
Online capacity expansion	No
Cachecade	No
Local Key Management (LKM)	No
PCIe hot-plug of controller	No




Specification	Description
Multipath support	Required for systems with Fault Tolerant Shared PERC 8 card configuration.   <b>NOTE:</b> Multipath is not supported on systems running Linux operating system.
Controller failover	Available only for systems with Fault Tolerant Shared PERC 8 card configuration.

## Supported Operating Systems

The Shared PERC 8 card supports the following operating systems:

- Microsoft Windows Server 2012 R2
- Microsoft Windows Server 2012
- Microsoft Windows Server 2008 including Hyper-V virtualization
- Microsoft Windows Server 2008 R2
- Red Hat Enterprise Linux 6 Update 5
- SUSE Enterprise Linux 11 SP3
- VMware ESXi 5.1 UP1 and above
- VMware ESXi 5.5, ESXi, 5.5 UP1 and above

 **NOTE:** For information on supported software and hardware for the *PowerEdge VRTX system*, see the *PowerEdge VRTX Storage Subsystem Compatibility Matrix* at [dell.com/support/manuals](http://dell.com/support/manuals).

## Best Practices For Shared PERC 8


- Always use the latest firmware and drivers from [dell.com/support/drivers](http://dell.com/support/drivers).
- Always keep a copy of your virtual disk configuration and server node mapping information. To document your virtual drive configuration and mapping information, perform the following steps:
  - a. Open CLI terminal and run the command `racadm raid get vdisks -o`. Take a screen shot of the results page and save the captured screen shot to a location of choice, or write down the information and store it in a safe, secure location.
  - b. Click **Chassis Overview** → **Storage** → **Virtual Disks** → **Assign** to view the virtual disk mapping by the CMC GUI. Take a screen shot of the results page and save the captured screen shot to a location of choice, or write down the information and store it in a safe, secure location.
  - c. Click **Chassis Overview** → **Storage** → **Virtual Disks** to get the virtual disk configuration information by the CMC GUI. Take a screen shot of the results page and save the captured screen shot to a location of choice, or write down the information and store it in a safe, secure location.

## Related Documentation

 **WARNING:** See the safety and regulatory information that shipped with your system. Warranty information may be included within this document or as a separate document.

- The *Dell PowerEdge VRTX Getting Started Guide* shipped with your system provides an overview of system features, setting up your system, and technical specifications.

- The *PowerEdge VRTX Storage Subsystem Compatibility Matrix* provides information on the minimum driver and firmware requirements for the components of the Dell PowerEdge VRTX storage subsystem.
- The setup placemat shipped with your system provides information on the initial system setup and configuration.
- The server module Owner's Manual provides information about the server module features and describes how to troubleshoot the server module and install or replace the server module components. This document is available online at [dell.com/poweredgemanuals](http://dell.com/poweredgemanuals).
- The *Updating Servers of M1000e Chassis and Using in VRTX Chassis* provides information on updating M1000e server modules to be used in the VRTX chassis, using the Chassis Management Controller. This document is available online at [dell.com/esmmanuals](http://dell.com/esmmanuals).
- The rack documentation included with your rack solution describes how to install your system into a rack, if required.
- The I/O module documentation at [dell.com/poweredgemanuals](http://dell.com/poweredgemanuals) describes the features of the I/O module installed in the VRTX enclosure.
- The *Dell Shared PowerEdge RAID Controller (PERC) 8 User's Guide* provides information about deploying the Shared PERC 8 card and managing the storage subsystem. This document is available online at [dell.com/storagecontrollermanuals](http://dell.com/storagecontrollermanuals).
- The *Dell Chassis Management Controller for Dell PowerEdge VRTX User's Guide* provides information on installing, configuring and using the Chassis Management Controller (CMC). This document is available online at [dell.com/esmmanuals](http://dell.com/esmmanuals).
- The *Dell PowerEdge VRTX Chassis Management Controller Firmware Event Message Reference Guide* provides information on the error and event messages generated by the firmware or other agents that monitor system components. This document is available at [dell.com/esmmanuals](http://dell.com/esmmanuals).
- The *CMC Online Help* provides information and instructions for the current page on the CMC web interface. To access the *Online Help*, click **Help** on the CMC web interface.
- The *Integrated Dell Remote Access Controller (iDRAC) User's Guide* provides information about installation, configuration and maintenance of the iDRAC on managed systems. This document is available online at [dell.com/esmmanuals](http://dell.com/esmmanuals).
- Dell systems management application documentation provides information about installing and using the systems management software.
- For the full name of an abbreviation or acronym used in this document, see the Glossary at [dell.com/support/manuals](http://dell.com/support/manuals).
- Any media that ships with your system that provides documentation and tools for configuring and managing your system, including those pertaining to the operating system, system management software, system updates, and system components that you purchased with your system.

 **NOTE:** Always check for updates on [dell.com/support/manuals](http://dell.com/support/manuals) and read the updates first because they often supersede information in other documents.

## Locating your system Service Tag

Your system is identified by a unique Express Service Code and Service Tag number. The Express Service Code and Service Tag are found on the front of the system by pulling out the information tag. Alternatively, the information may be on a sticker on the chassis of the system. This information is used by Dell to route support calls to the appropriate personnel.

## Contacting Dell

Dell provides several online and telephone-based support and service options. If you do not have an active Internet connection, you can find contact information on your purchase invoice, packing slip, bill,

or Dell product catalog. Availability varies by country and product, and some services may not be available in your area. To contact Dell for sales, technical support, or customer-service issues:

1. Go to **dell.com/support**.
2. Select your country from the drop-down menu on the bottom right corner of the page.
3. For customized support:
  - a. Enter your system Service Tag in the **Enter your Service Tag** field.
  - b. Click **Submit**.  
The support page that lists the various support categories is displayed.
4. For general support:
  - a. Select your product category.
  - b. Select your product segment.
  - c. Select your product.  
The support page that lists the various support categories is displayed.

## Documentation Feedback

If you have feedback for this document, write to [documentation\\_feedback@dell.com](mailto:documentation_feedback@dell.com). Alternatively, you can click on the **Feedback** link in any of the Dell documentation pages, fill up the form, and click **Submit** to send your feedback.

# Shared PERC 8 Card Features


Some of the features of the Shared PERC 8 card are as follows:

- Physical disk power management
- Consistency checks
- Virtual disk initialization
- Disk roaming
- FastPath
- Virtual disk migration
- Virtual disk cache policies
- Fault tolerance
- Patrol read
- Multipath support

## Physical Disk Power Management


Physical disk power management is a power saving feature of the Shared PERC 8 card. Idle-C feature, as defined by the T10 organization, is auto-enabled for physical disk power management. Physical disks that support Idle-C feature, spin at lower RPMs upon timer expiration when there is no I/O activity.

 **NOTE:** There is a delay to I/O operations when a configured disk is being spun up.


 **NOTE:** For detailed information about power management, see the *Dell Chassis Management Controller for Dell PowerEdge VRTX User's Guide* at [dell.com/poweredgemanuals](http://dell.com/poweredgemanuals).

## Consistency Checks

Consistency Check (CC) is a background operation that verifies and corrects the mirror or parity data for fault tolerant virtual disks. It is recommended that you periodically run a consistency check on virtual disks. You can manually start a CC in the Dell Chassis Management Controller (CMC).

 **NOTE:** For more information about consistency checks, see the *Dell Chassis Management Controller for Dell PowerEdge VRTX Online Help*.

## Virtual Disk Initialization


 **CAUTION:** Initializing virtual disks erases the files and file systems but keeps the virtual disk configuration intact. Initializing a virtual disk destroys all data on the virtual disk.

You can initialize virtual disks as described in the following sections.


## Background Initialization Of Virtual Disks

Both Consistency Check (CC) and Background Initialization (BGI) correct parity errors. However, CC reports data inconsistencies through an event notification, whereas BGI is an automatic process.

BGI does not run on RAID 0 virtual disks. You cannot disable BGI permanently. If you cancel BGI, it automatically restarts within five minutes. Unlike full or fast initialization of virtual disks, BGI does not clear data from the physical disks. CC or BGI typically causes some loss in performance until the operation completes.

 **NOTE:** In systems with Fault Tolerant Shared PERC 8 card configuration, in the event of controller failover, a BGI starts automatically on each virtual disk. If a BGI operation was in progress at the time of controller failover, then the BGI resumes on the new active Shared PERC 8 controller from the last recorded checkpoint.


## Full Initialization Of Virtual Disks

 **CAUTION:** Performing a full initialization on a virtual disk overwrites all blocks and destroys any data that previously existed on the virtual disk. Full initialization of a virtual disk eliminates the need for the virtual disk to undergo a BGI. Full initialization can be performed after the creation of a virtual disk.

During full initialization, the host is not able to access the virtual disk. You can start a full initialization on a virtual disk in the CMC.


In the event of a controller failover in systems with Fault Tolerant Shared PERC 8 card configuration, full initialization does not continue on the active controller. You must start full initialization again through CMC. For more information on virtual disk initialization, see the *Dell Chassis Management Controller for Dell PowerEdge VRTX User's Guide* at [dell.com/poweredgemanuals](http://dell.com/poweredgemanuals) and the *Dell Chassis Management Controller for Dell PowerEdge VRTX Online Help*.

In the event of controller failover or system reboot during a full initialization, the operation terminates and a BGI begins on the virtual disk.

 **NOTE:** Performing a full initialization prevents a BGI from starting automatically on virtual disks.

## Fast Initialization Of Virtual Disks

A fast initialization on a virtual disk overwrites the first and last 8 MB of the virtual disk, clearing any boot records or partition information. The operation takes only 2-3 seconds to complete and is recommended when you are recreating virtual disks. You can perform a fast initialization in the CMC.

 **NOTE:** A BGI starts five minutes after the Fast Initialization is completed.

## Physical Disk Roaming

Physical disk roaming is moving the physical disks from one backplane slot to another on the same controller. The controller automatically recognizes the relocated physical disks and logically places them in the virtual disks that are part of the disk group. You can perform disk roaming only when the system is turned off.

## Using Physical Disk Roaming

Perform the following steps to use disk roaming:

1. Turn off the power to the system, physical disks, enclosures, and system components.
2. Disconnect power cables from the system.
3. Move the physical disks to the required positions on the backplane or the enclosure.
4. Perform a safety check. Make sure the physical disks are inserted properly.
5. Turn on the system.

The controller detects the RAID configuration from the configuration data on the physical disks.

## FastPath

The Shared PERC 8 card supports **FastPath** feature, which improves application performance by delivering high I/O per second (IOPS).

Under specific conditions with **FastPath**, the I/O bypasses the controller cache and is committed directly to the physical disk from the host memory or directly from the physical disk. All simple non-spanned virtual disks configured with Write-Through write-cache policy and No Read-Ahead read-cache policy can utilize FastPath.

Workloads on SSD volumes provide the most performance improvement with FastPath.

The following conditions support **FastPath**:

- Random workloads with small blocks.
- I/O block sizes smaller than virtual disk's stripe size.
- Sequential read workloads on unspanned RAID volumes (RAID 0, RAID 1, RAID 5, and RAID 6).
- Sequential read and write workloads on RAID 0 virtual disks.

The following conditions do not support **FastPath**

- Virtual disks running background operations like rebuild, initialization, and so on.
- Spanned RAID volumes like RAID 10, RAID 50, and RAID 60.

## Virtual Disk Migration

The Shared PERC 8 card supports migration of virtual disks from one controller to another without taking the target controller offline. The controller can import RAID virtual disks in optimal, degraded, or partially degraded states.


Conditions that do not support virtual virtual disk migration:

- Does not support migration of virtual disk that is in a failed state.
- Does not support migration of virtual disk when the source system is turned on.

Conditions that support virtual virtual disk migration:


- Supports migration of virtual disks from a similar Shared PERC 8 card.

- Does not support migration from any other PERC cards such as PERC H310, H700, H710, H800, and H810.
- Supports migration of virtual disks from the Single Shared PERC 8 card configuration to the Fault Tolerant Shared PERC 8 card configuration, but does not support migration from a newer firmware version to an older firmware version system.
- Supports migration of virtual disks from another system's Shared PERC 8 controller when the target system is either turned on or off

 **NOTE:** When a controller detects a physical disk with an existing configuration, it flags the physical disk as a foreign disk and generates an alert indicating that a foreign disk was detected.

## Migrating Virtual Disks If The Target System Is Turned Off


1. If installed, remove the front bezel (optional) from the PowerEdge VRTX enclosure.
2. Power down the server module using the operating system commands or the CMC, and ensure that the server module's power is off.
3. Turn off the chassis using CMC.


 **NOTE:** For information about the chassis shutdown, refer to the *Dell Chassis Management Controller for Dell PowerEdge VRTX User's Guide* at [dell.com/esmmanuals](http://dell.com/esmmanuals).

4. Move the appropriate physical disks from the source system to the target system with a similar Shared PERC 8 controller.
5. Turn on the target system.  
The system discovers and automatically imports the detected foreign configuration.

## Migrating Virtual Disks If The Target System Is Turned On

1. Turn off the source system.
2. Move the appropriate physical disks from the source system to the target system with a similar Shared PERC 8 card.
3. Access the Dell Chassis Management Controller (CMC) to import and clear the foreign configuration.

 **NOTE:** For more information on importing or clearing the foreign configuration, see the *Dell Chassis Management Controller for Dell PowerEdge VRTX User's Guide* at [dell.com/poweredgemanuals](http://dell.com/poweredgemanuals).

 **NOTE:** If write cache is enabled for these virtual disks, ensure that all cache is flushed to the hard drives on the source system before migrating them. This can be accomplished by stopping all applications, powering down the blades, and waiting 30 seconds before powering down the chassis.

## Virtual Disk Cache Policies


The following Virtual Disk Cache policies are supported on Shared PERC 8:

- Virtual disk write cache policies
- Virtual disk read cache policies

## Virtual Disk Write Cache Policies

The write cache policy of a virtual disk determines how the controller handles writes to the virtual disk. Write-Back and Write-Through are the two write cache policies that can be set on virtual disks individually.


All RAID volumes are presented as Write-Through to the operating system independent of the actual write cache policy of the virtual disk. The Shared PERC 8 cards manage data in the cache independently of the operating system or any applications.

 **NOTE:** Use the Dell Chassis Management Controller (CMC) to view and manage virtual disk cache settings.

### Write-Back

In Write-Back caching, the controller sends a data transfer completion signal to the host when the controller cache has received all the data in a transaction. The controller then writes the cached data to the storage device in the background.

The risk of using Write-Back cache is that the cached data can be lost if there is a power failure during or when the data is written to the storage device. This risk is mitigated by using a Non-Volatile Cache on the Shared PERC 8 card.


 **NOTE:** The default cache setting for virtual disks in single and dual controller systems is Write-Back caching.

### Conditions Under Which Write-Back Is Employed

Write-Back caching is the default caching mode for single and dual Shared PERC 8 card configurations. Write-Back caching can be configured under all conditions in which the battery is present and in good condition.

If a virtual disk is already created on the VRTX system with the firmware version that does not support write-back caching, then the default will remain as write-through. The virtual disk must be manually changed to write-back before it goes to write-back mode, even if the system has been updated to a write-back supported firmware version.


### Conditions Under Which Forced Write-Back With No Battery Is Employed

 **CAUTION:** It is recommended that you use a power backup system when forcing Write-Back to ensure there is no loss of data if the system loses power.


Write-Back mode is available when you select Write-Back Force. When Write-Back Force mode is selected, the virtual disk is in Write-Back mode even if the battery is not present.

### Write-through

In Write-Through caching, the controller sends a data transfer completion signal to the host system when the disk subsystem has received all the data in a transaction.

 **NOTE:** Most configurations and workloads experience some reduction in performance when configured with Write-Through cache, as compared to Write-Back cache.



 **NOTE:** If the virtual drives are created with write-through as selected mode, make sure that the virtual drives are changed to write-back mode.


## Conditions under which write-through is employed

Write-through caching is used under conditions in which the battery fails or is not present.

## Virtual Disk Read Cache Policies

The read policy of a virtual disk determines how the controller handles reads to that virtual disk. The read policies are:


- **Read Ahead** — Allows the controller to read sequentially ahead of the requested data and store the additional data in cache memory. This speeds up reads for sequential data, but there is little improvement when accessing random data.
- **No Read Ahead** — Disables the **Read-Ahead** capability.
- **Adaptive Read Ahead** — Begins using **Read-Ahead** if the two most recent disk accesses occurred in sequential sectors. If the read requests are random, the controller reverts to **No Read Ahead** mode.


 **NOTE:** The default read cache setting for virtual disks is **Adaptive Read Ahead**.

## Physical Disk Write Cache Policy

Management utilities provide the option to modify disk cache policies for physical disks associated with a virtual disk. The following options are available for the Shared PERC controller:

Option	Description
<b>Enabled</b>	Enables physical disk cache for drives associated with the selected virtual disk.
<b>Disabled</b>	Disables physical disk cache for drives associated with the selected virtual disk.
<b>Default</b>	The default cache policy on the physical disk is used. See the physical disk documentation for details on the default setting.

 **WARNING:** Enabling physical disk cache is not recommended for disks with critical data as a power failure may result in the loss of data prior to it being flushed to the persistent media.

 **NOTE:** Any changes to the physical disk cache applies to all virtual disks in an entire disk group. It is not possible to have different cache policies on virtual disks from the same disk group.

## Fault Tolerance

The fault tolerance features of Shared PERC 8 are as follows:

- Support for Self Monitoring and Reporting Technology (SMART)
- Support for Patrol Read
- Physical disk failure detection
- Physical disk rebuild using hot spares
- Controller Cache Preservation
- Battery and Non-Volatile Cache backup of controller cache to protect data
- Detection of batteries with low charge after boot up


- Support for controller failover in systems with Fault Tolerant Shared PERC 8 card configuration.

The following sections describe some methods to achieve fault tolerance.

## The SMART Feature

The SMART feature monitors certain physical aspects of all motors, heads, and physical disk electronics to help detect predictable physical disk failures. Data on SMART-compliant physical disks can be monitored to identify changes in values and determine whether the values are within threshold limits. Many mechanical and electrical failures display some degradation in performance before failure.

A SMART failure is also referred to as predicted failure. There are numerous factors that are predicted physical disk failures, such as a bearing failure, a broken read/write head, and changes in spin-up rate. In addition, there are factors related to read/write surface failure, such as seek error rate and excessive bad sectors.


 **NOTE:** For detailed information on SCSI interface specifications, see [t10.org](http://t10.org) and for detailed information on SATA interface specifications, see [t13.org](http://t13.org).


## Patrol Read

The **Patrol Read** feature is designed as a preventive measure to ensure physical disk health and data integrity. **Patrol Read** scans for and resolves potential problems on configured physical disks. The Dell Chassis Management Controller (CMC) can be used to start and control the features of **Patrol Read**.

The following is an overview of **Patrol Read**:

- **Patrol Read** runs on all disks on the controller that are configured as part of a virtual disk, including hot spares.
- **Patrol Read** does not run on physical disks that are not part of a virtual disk or are in **Ready** state.
- **Patrol Read** adjusts the amount of controller resources dedicated to **Patrol Read** operations based on outstanding disk I/O. For example, if the system is busy processing I/O operation, then **Patrol Read** uses fewer resources to allow the I/O to take a higher priority.
- **Patrol Read** does not run on disks involved in any of the following operations:
  - Rebuild
  - Replace Member
  - Full or Background Initialization
  - Consistency Check (CC)

 **NOTE:** By default, **Patrol Read** automatically runs every seven days on configured SAS hard drives. **Patrol Read** is not necessary on SSD and is disabled by default.


 **NOTE:** In the event of a controller failover in systems with Fault Tolerant Shared PERC 8 card configuration, **Patrol Read** does not continue on the active controller. You must start **Patrol Read** again through CMC. If you do not start **Patrol Read**, it automatically starts on the active controller within seven days of the failover.

For more information on **Patrol Read**, see the *Dell Chassis Management Controller for PowerEdge VRTX Online Help*.

## Physical disk failure detection

Failed physical disks are detected and rebuilds automatically start to new disks that are inserted into the same slot. Automatic rebuilds can also occur with hot spares. If you have configured hot spares, the controllers automatically try to use them to rebuild failed physical disks.

## Physical Disk Hot Swapping


 **NOTE:** Shared PERC 8 supports physical disk hot-swapping, however this should only be implemented for unconfigured or failed drives.


Hot swapping is the manual replacement of a disk while the Shared PERC 8 card is online and performing the normal functions. The following requirements must be fulfilled before performing a hot swap of a physical disk:

- The replacement disk must be of the same protocol and disk technology. For example, only a SAS hard drive can replace a SAS hard drive.
- The replacement disk must be of equal or greater capacity than the one it is replacing.

## Auto Replacement Of A Virtual Disk Member And Revertible Hot Spares


The automatic Replace Member functionality allows a previously commissioned hot spare to be reverted to a usable hot spare. When a disk failure occurs within a virtual disk, an assigned hot spare (dedicated or global) is commissioned and begins rebuilding until the virtual disk is optimal. After the failed physical disk is replaced (in the same slot) and the rebuild is complete, the Shared PERC 8 card automatically starts to copy data from the commissioned hot spare to the newly-inserted disk. After the data is copied, the new disk is a part of the virtual disk and the hot spare is reverted to a ready hot spare. This allows hot spares to remain in specific enclosure slots. While the Shared PERC 8 card is reverting the hot spare, the virtual disk remains optimal.

 **NOTE:** The Shared PERC 8 card automatically reverts a hot spare only if the failed disk is replaced with a new disk in the same slot.

 **NOTE:** A Replace Member operation typically has a temporary impact on disk performance. After the operation completes, the disk performance returns to normal.

## Shared PERC 8 Card Cache Preservation

The Shared PERC 8 card is capable of preserving its cache in the event of a system power outage or improper system shutdown. The Shared PERC 8 card is attached to a Battery Backup Unit (BBU) that provides backup power to transfer contents of the DRAM to the Non-Volatile Cache (NVC) during system power loss.

 **NOTE:** The Controller Cache Preservation feature is applicable only for virtual disks in write-back mode. Virtual disks in write-through mode do not have any data in cache.

## Cache Preservation With Non-Volatile Cache




The Cache Preservation With Non-Volatile Cache (NVC) module allows controller cache data to be stored indefinitely. If the controller has data in the cache memory during a power outage or improper system shutdown, a small amount of power from the battery is used to transfer cache data to a non-volatile flash storage where it remains until power is restored and the system is booted.

## Recovering cache data

If a system power loss or improper system shutdown has occurred:


1. Ensure all online physical disks are still connected.
2. Restore the system power.
3. Boot the system.

Virtual disks are automatically imported and preserved cache (if any) will be flushed to the physical disks of appropriate virtual disks. If preserved cache is still present, there could be situations preventing the flushing of preserved cache data.

-  **NOTE:** For more information on recovering the cache data, see the *Dell Chassis Management Controller for Dell PowerEdge VRTX User's Guide* at [dell.com/poweredgemanuals](http://dell.com/poweredgemanuals).
-  **NOTE:** If there is preserved cache in Shared PERC 8, you can clear the preserved cache in the CMC. If there is no preserved cache, this option is not displayed in CMC which indicates that the preserved cache data is recovered and written to the physical disks successfully.
-  **NOTE:** If preserved cache is discarded, preserved cache data is not written to the physical disks. Ensure that the preserved cache data is not critical before discarding.

## Battery Transparent Learn Cycle

A transparent learn cycle is a periodic operation that calculates the charge that is remaining in the battery to ensure there is sufficient energy. The operation runs automatically, and causes no impact to the system or Shared PERC 8 card performance. The Shared PERC 8 card automatically performs the Transparent Learn Cycle (TLC) on the battery to calibrate and gauge its charge capacity once every 90 days.

-  **NOTE:** Virtual disks stay in Write-Back mode, if enabled, during transparent learn cycle. If the TLC completes, the Shared PERC 8 card sets the next TLC to +90 days.

### TLC Time Frame

The time frame for completion of a learn cycle is a function of the battery charge capacity and the discharge and charge currents used. For Shared PERC 8 card, the expected time frame for completion of a learn cycle is approximately seven hours.

### Conditions For Replacing The Battery

The Shared PERC 8 battery is marked **Failed** in the **Battery Status** in the CMC, when the state or health of the battery is declared bad. If battery is declared failed, then the firmware runs learn cycles in subsequent reboots until the battery is replaced. After the battery is replaced, the virtual disk then transitions to Write-Back mode.

## The Controller Failover Feature

The dual-controller configuration of the VRTX system has two shared-PERC controllers configured in an active-passive mode. A single active controller monitors all the storage related processes. When the active controller stops functioning, the passive controller acts as a peer hot-spare, and takes over the functions of the active controller in a seamless manner. Although the transition is seamless with respect to the operating system, there may be some temporary performance impact in the course of the failover.

# Multipath Support

Multipathing solutions use redundant physical path components such as adapters, cables, and switches to create logical paths between the server and the storage device. In the event that one or more of these components fails, multipathing logic uses an alternate path for I/O so that applications can still access their data.

In the Fault Tolerant Shared PERC 8 card configuration, the PowerEdge VRTX system has two Shared PERC 8 cards in an active-passive mode. In this configuration, each host server can access the same virtual disk through both cards. In the absence of a multipath driver, the operating system identifies the single disk as two identical disks. The multipath driver aggregates the two disks into a single disk with redundant access that is then presented to the operating system. The MPIO driver determines the path chosen for any I/O sent to the virtual disk. Any I/O directed to the passive card is internally redirected to the active card for completion.

## Configuring Multipath Support In Windows

In Windows, multipath support is enabled by installing the MPIO driver. The Shared PERC 8 device must be added to the list of devices that are aggregated by MPIO after the device driver is installed. Perform the following steps to add the Shared PERC 8 card:

1. Open the MPIO control panel.
2. Click the **Discover Multi-Paths** tab.
3. Select **DELL Shared PERC8** and click **Add**.

This is only a one time setup procedure. After the Shared PERC 8 device is added to the list of devices, the MPIO driver aggregates all instances of the same virtual disk into a single one. The recommended multipath policy for Windows is round-robin (with subset).

## Configuring Multipath Support In VMWare

In VMWare, multipath support is automatically enabled using Native Multipathing (NMP) for all Shared PERC 8 cards in Dell versions of the ESXi operating systems.

 **NOTE:** The recommended multipath policy is Most Recently Used (MRU).

## Multipath support in Linux

Currently, Linux support is not offered by Dell on fault tolerant VRTX configurations.

# Deploying The Shared PERC 8 Card

Follow the documentation in this section to remove or install a Shared PERC 8 card under different scenarios.

## Installing A New Shared PERC 8 Card

For information on how to install a Shared PERC 8 card, see [Installing The Shared PERC 8 Card](#).

For information on the post-installation tasks, see [Post-Installation Tasks For Shared 8 Card](#).


## Replacing A Shared PERC 8 Card


When replacing an existing Shared PERC8 card in the PowerEdge VRTX system, perform the steps in this chapter to ensure proper functionality of the shared storage after the replacement process is complete.

 **CAUTION: The Shared PERC 8 cards are not hot-swappable. Do not remove or install the Shared PERC 8 cards from the system board while the PowerEdge VRTX system is powered-on.**

In the Single Shared PERC 8 card configuration, the shared PERC slot is labeled as **INT\_STORAGE\_1** on the PowerEdge VRTX system board. In the Fault Tolerant Shared PERC 8 card configuration, the shared PERC slots are labeled as **INT\_STORAGE\_1** and **INT\_STORAGE\_2** on the PowerEdge VRTX system board. To locate the Shared PERC slots, see **System Board Connectors** in the Dell PowerEdge VRTX Enclosure Owner's Manual at [dell.com/poweredgemanuals](http://dell.com/poweredgemanuals).

Controller firmware package 23.8.10-0059 is the minimum firmware package version required for fault tolerant Shared PERC 8 configurations on PowerEdge VRTX.


 **NOTE:** Write-back caching in a fault tolerant configuration is not supported with firmware version 23.8.10-0061 and the earlier versions.

 **NOTE:** For write-back caching capability, ensure that all the storage solution components are updated with the latest firmware.




For more information, see the storage subsystem compatibility matrix document at [dell.com/support/home](http://dell.com/support/home)

For information on removing and reinstalling system parts, see the *VRTX Enclosure Owner's Manual* of the system at [dell.com/poweredgemanuals](http://dell.com/poweredgemanuals).



## Prerequisites For Removing The Shared PERC 8 Card

-  **CAUTION:** Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the system.

Perform the following steps to enable recovery in the event the part replacement process fails:

1. Follow the operating system procedure to back up all data from the shared storage drives
  -  **CAUTION:** The part replacement procedure is complex and can put your data at risk if mistakes are made. It is imperative that critical data is backed up prior to starting the procedure.
2. Document your virtual drive configuration and mapping information by performing the following steps:
  - a. Open CLI terminal and run the command **racadm raid get vdisks -o**. Take a screen shot of the results page and save the captured screen shot to a location of choice, or write down the information and store it in a safe, secure location.
  - b. Click **Chassis Overview** → **Storage** → **Virtual Disks** → **Assign** to view the virtual disk mapping by the CMC GUI. Take a screen shot of the results page and save the captured screen shot to a location of choice, or write down the information and store it in a safe, secure location.
  - c. Click **Chassis Overview** → **Storage** → **Virtual Disks** to get the virtual disk configuration information by the CMC GUI. Take a screen shot of the results page and save the captured screen shot to a location of choice, or write down the information and store it in a safe, secure location.
3. Click **Chassis Overview** → **Storage** → **Controllers** to view the firmware version of the current Shared PERC 8 card. If your system has two Shared PERC 8 cards installed, the firmware version must be the same for both the cards.
4. Turn off the server modules using operating system commands or the CMC.
5. Turn off the enclosure, including any attached peripherals, and disconnect the enclosure from the electrical outlet and peripherals.
6. Remove the server modules and the shared storage hard drives from the PowerEdge VRTX system.
  -  **WARNING:** To prevent damage to system components, do not stack system components together after removal. For information on electrostatic discharge (ESD) compliance, see [dell.com/regulatory\\_compliance](http://dell.com/regulatory_compliance).
  -  **NOTE:** Label all server modules and hard drives before removal so that they can be replaced in the same slots.
7. If applicable, rotate the system feet inward and lay the system on its side on a flat stable surface, with the cover release latch side on top.
8. Open the system.

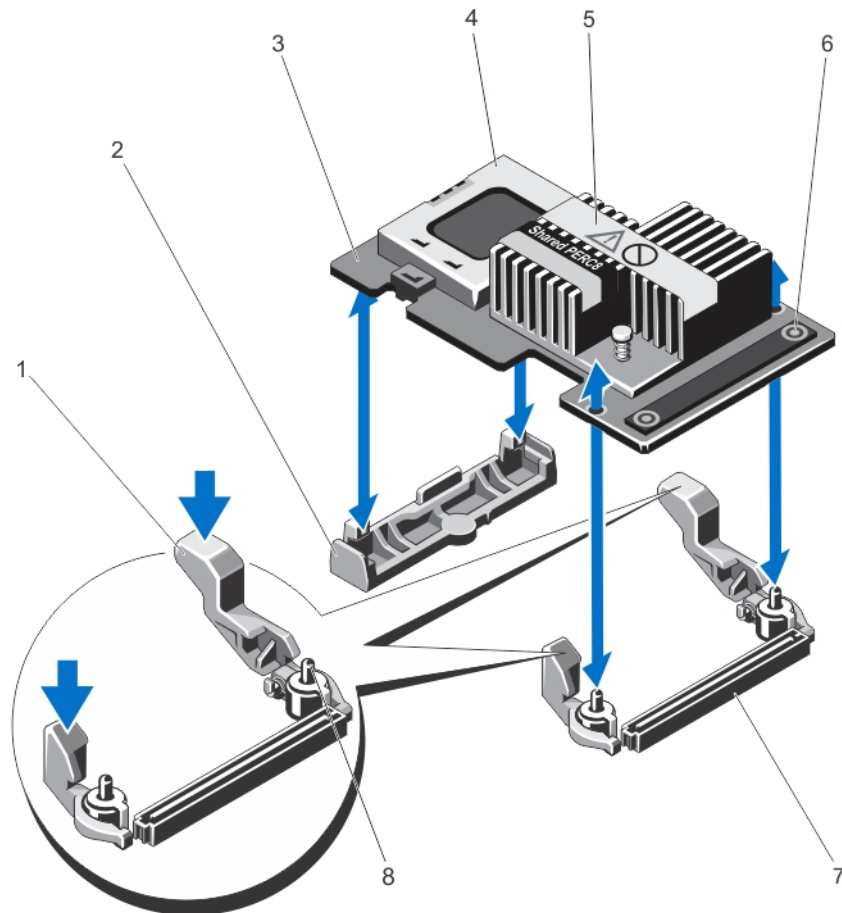
## Removing The Shared PERC 8 Card

-  **CAUTION:** Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the system.
-  **CAUTION:** The Shared PERC 8 cards are not hot-swappable. Do not remove or install the Shared PERC 8 cards from the system board while the PowerEdge VRTX system is powered on.

To remove the Shared PERC 8 card:

1. Push down the two release levers at the edge of the Shared PERC 8 card to disengage the card from the storage-controller card holder.
2. Orient the card so that the other end of the card disengages from the storage-controller card holder on the system board.

**⚠ CAUTION: When removing or replacing the Shared PERC 8 card, hold the card by its edges. Do not handle the card while holding the battery or the heatsink.**




**Figure 1. Removing and Installing the Shared PERC 8 Card**


- |  |                                   |
|--|-----------------------------------|
| 1. release lever (2)                                     | 2. storage-controller card holder |
| 3. storage controller card                               | 4. battery                        |
| 5. heatsink  | 6. touch points (2)               |
| 7. storage-controller card connector on the system board | 8. guide pins (2)                 |




## Installing The Shared PERC 8 Card

 **CAUTION:** Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.

1. Align one end of the card with the card holder on the system board.
2. Lower the other end of the card into the storage-controller card holder on the system board.

 **CAUTION:** Applying pressure on the heat sink or battery while seating the Shared PERC 8 card may cause damage to the card. Use only the touch points to seat the card.

3. Press the touch-points on the card and push the card down until it is fully seated.  
When the card is fully seated, the release levers snap over the edge of the card.


 **NOTE:** Before closing the system, ensure the release levers have snapped over the edge of the card.

4. Close the system.

## Post-Installation Tasks For Shared PERC 8 Card

1. Turn on the PowerEdge VRTX system without hard drives and server modules inserted.  
It may take up to 25 minutes for the PowerEdge VRTX storage subsystem to completely power on.
2. Log in to the CMC GUI.
3. Click **Overview** → **Power** → **Control**, and view the **Power State** to ensure that it is **ON**.
4. Click **Chassis Overview** → **Storage** → **Controllers** to view the firmware version of the replaced Shared PERC 8 card.

The firmware version must be same for both the cards.

 **NOTE:** If the Shared PERC 8 cards have different versions of their firmware, download and update the firmware to the latest version from [dell.com/drivers](http://dell.com/drivers).

5. If the system has two Shared PERC 8 cards, ensure that the **Fault Tolerance Status** is **Healthy/Normal**. This is necessary to ensure that any new firmware has been initialized and is compatible before you reinsert the shared hard drives and modular servers.
6. Turn off the PowerEdge VRTX system.
7. Insert the shared storage hard drives that you had removed earlier. Insert the shared hard drives in the original slots.
8. Turn on the PowerEdge VRTX system.
9. Check the **Virtual Disk Layout** and the **Virtual Disk Assignments** in the CMC GUI. If the virtual disks are not imported, not present, or the virtual disk assignments are not present or are incorrect, contact Dell Technical Support.
10. Turn off the PowerEdge VRTX system.
11. Insert the server modules that you had removed earlier. Insert the server modules in the original slots.
12. Turn on the PowerEdge VRTX system.
13. Turn on the server modules.

## Firmware installation or update


The VRTX storage subsystem comprises of Shared PERC firmware, drivers, Chassis Infrastructure firmware and the CMC. When updating any of these components, make sure that all the component versions are at a compatible baseline.


 **NOTE:** For more information, see the *PowerEdge VRTX Storage Subsystem Compatibility Matrix* at [dell.com/support/home](https://dell.com/support/home).


### Updating firmware

Before you begin, download the windows update package for the firmware.

1. Log in to the VRTX CMC.
2. Make sure that you turn off all the server modules.
3. Navigate to **Storage** and click the **Update** tab.
4. Browse to the location where you downloaded the file and select the new file.
5. Click **Upload**.
6. After the file transfer, select the check box next to the release version, and click **Update**.

 **NOTE:** Shared PERC8 firmware can only be updated from the VRTX Chassis Management Controller. The firmware DUP will not respond if it is run in Windows from a server.


 **NOTE:** The firmware upgrade may fail if the RAID controller in the system is performing an I/O background task (that is, consistency check, background initialization, rebuild, or reconstruction). Ensure that you allow the background task to complete before attempting to upgrade the firmware.


 **NOTE:** Patrol Read tasks will not affect a firmware upgrade.

## Driver Installation



The Dell Shared PowerEdge RAID Controller (PERC) 8 card requires software drivers to operate with the supported operating systems.

This chapter contains the procedures for installing the drivers for the Shared PERC 8 card.

 **NOTE:** To check operating system compatibility, see [dell.com/ossupport](http://dell.com/ossupport).

 **NOTE:** Shared PERC 8 does not support booting to the shared storage.

### Downloading Drivers and Firmware For Shared PERC 8 From The Dell Support Website For All Operating Systems

1. Go to [dell.com/drivers](http://dell.com/drivers).
2. In the **Product Selection** section, enter the service tag of your system in the **Service Tag or Express Service Code** field.
  -  **NOTE:** If you do not have the service tag, select **Automatically detect my Service Tag for me** to allow the system to automatically detect your service tag, or select **Choose from a list of all Dell products** to select your product from the **Product Selection** page.
  -  **NOTE:** To download the latest firmware and drivers for a server module (for example Dell PowerEdge M520, M620, and M820), enter the service tag or the model number of the server module. To download the latest firmware and driver for components inside the PowerEdge VRTX chassis (for example Shared PERC 8 firmware and driver), enter the service tag or the model number of the PowerEdge VRTX chassis.
3. Select the **Operating System**, **Category**, **Release Date**, and **Importance** from the respective drop-down lists.

The drivers that are applicable to your selection are displayed.
4. Download the drivers that you require to a diskette drive, USB drive, CD, or DVD.
5. During the operating system installation, use the media that you created with the **Load Driver** option to load mass storage drivers. For more information on reinstalling the operating system, see the operating system document at [dell.com/operatingsystemmanuals](http://dell.com/operatingsystemmanuals).

### Downloading Drivers From The Dell Systems Service And Diagnostic Tools Media For Windows

To download drivers from the *Dell Systems Service and Diagnostic Tools* media:

1. Insert the *Dell Systems Service and Diagnostics Tools* media in a system.




The **Welcome to Dell Service and Diagnostic Utilities** screen is displayed.
2. Select your system model and operating system.




For the list of supported operating systems, see [Supported Operating Systems](#).


3. Click **Continue**.
4. From the list of drivers displayed, select the driver you require.
5. Select the self-extracting zip file and click **Run**.
6. Copy the driver to a diskette drive, CD, DVD, or USB drive.  
Repeat this step for all the drivers you require.
7. During the operating system installation, use the media that you created with the **Load Driver** option to load mass storage drivers.  
For more information on reinstalling the operating system, see the relevant document at [dell.com/support/manuals](http://dell.com/support/manuals).

## Installing Or Updating Windows Drivers For Shared PERC 8

This procedure is applicable for updating existing Windows Server 2008 R2 or Windows Server 2012/2012 R2 drivers.


-  **NOTE:** PERC H310/H710/H710P/H810 controllers use the same driver as Shared PERC 8 and do not require separate driver installations.
-  **NOTE:** For more information, see the *PowerEdge VRTX Storage Subsystem Compatibility Matrix* at [dell.com/support/home](http://dell.com/support/home).
-  **NOTE:** Close all applications on your system before you update the driver.

1. Insert the media (CD, DVD, or USB drive) containing the driver.
2. Select **Start** → **Settings** → **Control Panel** → **System**.  
The **System Properties** screen is displayed.
  -  **NOTE:** The path to **System Properties** may vary depending on the operating system family.
3. Click on the **Hardware** tab.
4. Click **Device Manager**.  
The **Device Manager** screen is displayed.
  -  **NOTE:** The path to **Device Manager** may vary depending on the operating system family.
5. Expand **SCSI and RAID Controllers** by double-clicking the entry or by clicking on the plus symbol next to **SCSI and RAID Controller**.
  -  **NOTE:** In Windows Server 2012 or Windows Server 2008, the Shared PERC 8 card is listed under **Storage Controllers**.
6. Double-click the RAID controller for which you want to update the driver.
7. Click the **Driver** tab and click **Update Driver**.  
The screen to update the device driver wizard is displayed.
8. Select **Install from a list or specific location**.
9. Click **Next**.
10. Follow the steps in the wizard and browse to the location of the driver files.
11. Select the INF file from the driver media (CD, DVD, or other media).
12. Click **Next** and continue with the installation steps in the wizard.
13. Click **Finish** to exit the wizard and reboot the system for the changes to take place.


-  **NOTE:** Dell provides the Dell Update Package (DUP) to update drivers on systems running Windows Server 2012/2012 R2 or Window Server 2008/2008 R2 operating systems. DUP is an executable application that updates drivers for specific devices. DUP supports command line interface and silent execution. For more information, see [dell.com/support](http://dell.com/support).

## Installing Or Updating Linux Drivers For Shared PERC 8

Use the procedures in this section to update the driver for Red Hat Enterprise Linux 6 Update 5 and SUSE Enterprise Linux 11 SP3. To ensure that you have the current version of the driver, download the updated Linux driver from [dell.com/support](http://dell.com/support).


-  **NOTE:** PERC H310/H710/H710P/H810 controllers use the same driver as Shared PERC 8 and do not require separate driver installations.

### Installing Or Updating The Driver Package On RHEL Using KMOD Support

-  **NOTE:** This procedure is applicable for Red Hat Enterprise Linux 6 SP5.

Perform the following steps to install the RPM package with KMOD support:

1. Uncompress the gzipped tarball driver release package.
2. Install the driver package using the command `rpm -ihv kmod-megaraid_sas-<version>.x86_64.rpm`


 **NOTE:** Use `rpm -Uvh <package name>` when upgrading an existing package.
3. Reboot the system for the updated driver to take effect.
4. Verify that the driver has been loaded using the command `modinfo megaraid_sas`
5. View the list of controllers installed on your system using the command `lspci | grep IOV`

### Installing Or Updating The Driver Package On SLES Using KMP Support

-  **NOTE:** This procedure is applicable for SUSE Enterprise Linux 11 SP3.

Perform the following steps to install the RPM package with KMP support:

1. Uncompress the gzipped tarball driver release package.
2. Install the driver package using the command `rpm -ihv kmod-megaraid_sas-<version>.x86_64.rpm`

 **NOTE:** Use `rpm -Uvh <package name>` when updating an existing package.
3. Reboot the system for the updated driver to take effect.
4. Verify that the driver is loaded using the command `modinfo megaraid_sas`
5. View the list of controllers installed on your system using the command `lspci | grep IOV`

## Installing Or Updating VMware Drivers For Shared PERC 8

For information on how to install drivers on VMware ESXi 5.1 and 5.5, see [kb.vmware.com/kb/2005205](http://kb.vmware.com/kb/2005205). For information on VMware ESXi drivers, see the VMware ESXi documentation at [dell.com/virtualizationsolutions](http://dell.com/virtualizationsolutions).


# Management Applications For Shared PERC 8 Card

The Dell Chassis Management Controller (CMC) enables you to:

- Configure the shared RAID system
- Create and manage multiple disk groups
- Control and monitor multiple RAID systems
- Provide online maintenance through a web interface or Command Line Interface (CLI)

 **NOTE:** Dell OpenManage Storage Management, BIOS Configuration Utility (<Ctrl> <L>), or Unified Extensible Firmware Interface (UEFI) RAID Configuration Utility does not support the Shared PERC 8 and may only be used to manage non-shared PERC cards. For non-shared PERC cards, see the system-specific PERC User's Guide at [dell.com/storagecontrollermanuals](http://dell.com/storagecontrollermanuals).

For more information on the CMC web interface or CLI commands available for Shared PERC 8, see the *Dell Chassis Management Controller for Dell PowerEdge VRTX User's Guide* at [dell.com/esmmanuals](http://dell.com/esmmanuals).

 **NOTE:** Ensure that all the software components are upgraded to the latest versions. For information on the latest supported firmware and driver versions, see the **Drivers and Downloads** link on [dell.com/support/drivers](http://dell.com/support/drivers) for your system.

# Troubleshooting

To get help with your Dell Shared PowerEdge RAID Controller Shared (PERC) 8 card, you can contact your Dell Technical Service representative or see [dell.com/contactdell](http://dell.com/contactdell).

## Performance variations between write-back and write-through cache modes

Performance is highly variable across configurations, drive type, applications and IO workloads. The write performance of write-through mode is typically lower than that of write-back mode. Some configurations and workloads exhibit significant performance deltas.

Evaluate your needs for maximum I/O performance (a single Shared PERC 8 configuration) versus maximum data protection (a Fault Tolerant Shared PERC 8 configuration).

## Shared PERC 8 Card Boots Into Safe Mode

In the event of some failure conditions encountered at boot, Shared PERC 8 boots with restricted capability in safe mode without user intervention. In such a condition Shared PERC 8 reports all configured disk drives as **Foreign** to the management application. The Dell Chassis Management Controller (CMC) displays events generated by the Shared PERC 8 card indicating the reason for booting into safe mode. The following table details the conditions and the corresponding event notifications that are reported to the CMC.

**Table 2. Conditions and the Corresponding Event Notifications Reported to the CMC**

Category	Event Reported To the CMC	Description of the Failure	Corrective Action
Pinned Cache	Controller cache pinned for missing or offline VDs: %s	The Shared PERC 8 card preserves dirty cache for a virtual disk that transitioned to offline or was deleted due to missing physical disks.	You can restore the preserved cache to the virtual disk once the original drives are re-inserted and the foreign configuration is imported.
SAS Discovery	Controller booted to safe mode due to critical errors Critical Error during boot - On-board expander FW or mfg image is corrupted - reflash image	This issue occurs if expanders are not detected.	Reseat and cable the expanders.

Category	Event Reported To the CMC	Description of the Failure	Corrective Action
	Critical Error during boot - NVDATA image is invalid - reflash NVDATA image	The NVData image is invalid.	Contact Dell Technical Support.

## Degraded State Of Virtual Disks

A redundant virtual disk is in a degraded state when one or more physical disks have failed or are inaccessible. For example, if a RAID 1 virtual disk consists of two physical disks and one of them fails or becomes inaccessible, the virtual disk becomes degraded.

To recover a virtual disk from a degraded state, you must replace the failed physical disk and rebuild it. After the rebuilding process is complete, the virtual disk state changes from degraded to optimal.

## General Issues

### Shared PERC 8 Card Has Yellow Exclamation Mark In Device Manager

- Issue:** The device is displayed in **Device Manager** but has a yellow exclamation mark (!).
- Corrective Action:** Reinstall the driver. For more information on reinstalling drivers, see [Driver Installation](#). If reinstalling the driver does not resolve the yellow exclamation mark, perform a shutdown of all server modules and power cycle the chassis.

### Shared PERC 8 Card Not Seen In Device Manager

- Issue:** The device does not appear in the **Device Manager**.
- Corrective Action:** In the Dell Chassis Management Controller (CMC) application, verify if the Shared PERC 8 is correctly mapped to the server module. For more information on assigning virtual adapters to server slots, see the *Dell Chassis Management Controller for Dell PowerEdge VRTX User's Guide* at [dell.com/poweredgemanuals](http://dell.com/poweredgemanuals).



**NOTE:** Make changes to **Virtual Adapter to Server Slot** mapping only when the server modules are turned off.

If the **Virtual Adapter to Server Slot** mapping is correct and the device still does not appear in the **Device Manager**, turn off the system and reseal the Shared PERC 8 card.

### Critical Errors Or Disk Warning Messages Seen In The Windows Event Log

- Issue:** Error messages such as Critical Event11, PERCSAS2The driver detected a controller error on \Device\RaidPort...  
or,



Warning event: Event 153, Disk

The IO operation at logical block address xxxxxx for Disk x was retried

referring to the PercSAS2 driver is seen in the **Windows Event** log .

**Corrective Action:** These error messages may be triggered under some non-critical cases. See the system status and the CMC logs to identify any persistent failures.

 **NOTE:** Event 153 or Event 11 seen in the **Windows Event** log do not require any corrective action.

## Shared PERC 8 Cards Fail To Function

**Issue:** Shared PERC 8 cards fail to function in systems with the Fault Tolerant Shared PERC 8 card configuration.

**Corrective Action:** This issue may occur if the Shared PERC 8 card property settings between the two Shared PERC 8 cards is not compatible. Make sure that the firmware packages are identical for both the Shared PERC 8 cards.

## Physical disk issues

### Incorrect Number of Virtual Disks Displayed In Windows Disk Manager

**Issue:** The number of disks displayed in **Windows Disk Manager** is more than the actual number of virtual disks assigned to the server.

**Corrective Action:** This issue occurs if the MPIO feature is not installed in systems with the Fault Tolerant Shared PERC 8 card configuration. Install MPIO services from the list of features that can be installed on the server. For instructions on how to install MPIO, see **Installing and Configuring MPIO** at [technet.microsoft.com](http://technet.microsoft.com).

### Physical Disk In Failed State

**Issue:** One of the physical disks in the disk array is in the failed state.

**Corrective Action:** Update the Shared PERC 8 cards to the latest firmware available on [dell.com/support](http://dell.com/support). Replace the physical disk with a working one which is compatible with the old physical disk and is of equal or greater capacity.

### Unable to rebuild a fault tolerant virtual disk

**Issue:** Cannot rebuild a fault tolerant virtual disk. For more information, see the alert log for virtual disks.


**Corrective Action:** The replacement disk is too small or not compatible with the virtual disk. Replace the failed disk with a compatible good physical disk with equal or greater capacity.

## Fatal Error Or Data Corruption Reported

**Issue:** Fatal error(s) or data corruption(s) is reported when accessing virtual disks.  
**Corrective Action:** Contact Dell Technical Support.

## Physical Disk Displayed As Blocked By Management Application

**Issue:** One or more physical disks are displayed as **Blocked** and cannot be configured.  
**Corrective Action:** Ensure the physical disk is supported by SCSI-3 Persistent Reservation (PR). Update the physical disk and Shared PERC 8 to the latest firmware available on [dell.com/support](http://dell.com/support).

 **NOTE:** If you are using the Dell Update Package (DUP) to update the physical disk, shutdown all the server modules and power cycle the chassis after the update is completed.

## Multiple Disks Become Inaccessible

**Issue:** Multiple disks become simultaneously inaccessible.  
**Corrective Action:** Multiple physical disk errors in a single array indicate a failure in cabling or connection and can involve loss of data. Perform the following steps to recover the virtual disk:



**CAUTION: Follow the safety precautions to prevent electrostatic discharge.**

1. Turn off the system, check the cable connections, and reseal the physical disks.
2. Ensure that all the disks are present in the enclosure.
3. Turn on the system and enter the **Chassis Management Controller (CMC)**.
4. Use the CMC to import the foreign configuration that is detected or clear the foreign configuration.



**NOTE:** For information about importing or clearing foreign configuration, see the *Dell Chassis Management Controller for Dell PowerEdge VRTX User's Guide* at [dell.com/poweredgemanuals](http://dell.com/poweredgemanuals).

If the virtual disk is redundant and transitioned to **Degraded** state before going **Offline**, a rebuild operation starts automatically after the configuration is imported. If the virtual disk has gone directly to the **Offline** state due to a cable pull or power loss situation, the virtual disk is imported in its **Optimal** state without a rebuild occurring.

## Rebuilding A Failed Physical Disk

**Issue:** Rebuilding a physical disk after one of them is in a failed state.  
**Corrective Action:** If you have configured hot spares, the Shared PERC 8 card automatically tries to rebuild a physical disk that is in a failed state. The automatic rebuild is not available if there is no hot spare with enough capacity to rebuild the failed physical disk. You

must make sure a physical disk with enough storage in the subsystem is set as a hot spare for rebuilding the physical disk.

## Virtual Disk Fails During Rebuild Using A Global Hot Spare

**Issue:** A virtual disk fails during rebuild while using a global hot spare. The global hot spare reverts to **Hotspare** state and the virtual disk is in **Failed** state.

**Corrective Action:** Check whether the original virtual disk has failed or has been removed.

## Virtual Disk Fails During Rebuild Using A Dedicated Hot Spare

**Issue:** A virtual disk fails during rebuild while using a dedicated hot spare. The dedicated hot spare goes to **Ready** state and the virtual disk goes to **Failed** state.

**Description:** Check whether the original virtual disk has failed or has been removed.

## Physical disk takes a long time to rebuild

**Issue:** A physical disk is taking longer than expected to rebuild.

**Description:** A physical disk takes longer to rebuild when under high stress. For example, there is one rebuild I/O operation for every five host I/O operations. You cannot add a second virtual disk to a disk group while the virtual disk in that disk group is undergoing a rebuild. The firmware does not allow you to create a virtual disk using the free space available in a disk group if a physical disk in a virtual disk group is undergoing a rebuild operation.





## Controller cache issues

For certain conditions virtual drives will be either not configured to write-back caching or if configured, it will transition to write-through caching. The status of write-back caching can be viewed through CMC storage logs.

The following table details the conditions and the corrective actions.


**Table 3. Conditions and the corrective actions**

Conditions	Actions
During the VRTX power on with no failing conditions, the virtual drive temporarily transitions to write-through as part of the Shared PERC 8 firmware initialization. After the system power on, the virtual drive transitions back to write-back.	There is no intervention required.
During VRTX power on or reset, unresolved pinned cache is present.	Perform the following: <ul style="list-style-type: none"><li>• Insert the drives that caused the virtual drive to go offline, that resulted in the cache being pinned to recover the virtual drive.</li><li>OR</li><li>• Clear the pinned cache through CMC.</li></ul>



Conditions	Actions
<p> <b>NOTE:</b> Unresolved pinned cache can occur if a virtual drive goes offline for any reason while there is uncommitted cache data in memory.</p> <p>During a Shared PERC firmware flash, virtual drive transitions to write-through until chassis is recycled.</p> <p>Virtual drives permanently transition to write-through when Hardware failure occurs.</p> <p>In the event of a firmware mismatch, in the dual fault tolerant Shared PERC 8 configurations, if one controller has write-through capability and the other does not, virtual drives on the controller with write-through capability reverts to write-through.</p> <p> <b>NOTE:</b> Virtual drives configured with forced write-back caching will not transition to write-through in the above conditions.</p>	<p> <b>NOTE:</b> Clearing pinned cache means that the pinned data is lost.</p> <p>Allow the chassis reset to complete after the firmware flash.</p> <p>If hardware failure occurs, contact Dell technical support. For more information, see the <a href="#">Getting help</a>.</p> <p>Update the firmware such that both cards are running the latest supported versions available.</p> <p> <b>NOTE:</b> Ensure that you download the updated firmware and driver version available at <a href="http://dell.com/support/home">dell.com/support/home</a>.</p>

## SMART Errors



Self Monitoring and Reporting Technology (SMART) monitors the internal performance of all motors, heads, and physical disk electronics and detects predictable physical disk failures.

 **NOTE:** For information about where to find reports of SMART errors that can indicate hardware failure, see the *Dell Chassis Management Controller for Dell PowerEdge VRTX User's Guide* at [dell.com/esmanuals](http://dell.com/esmanuals).

### SMART Error Detected On A Physical Disk In A Redundant Virtual Disk

<b>Issue:</b>	A SMART error is detected on a physical disk in a redundant virtual disk.
<b>Corrective Action:</b>	<p>Perform the following steps:</p> <ol style="list-style-type: none"> <li>1. Back up your data.</li> <li>2. Physically remove the physical disk that detected the SMART error. <ul style="list-style-type: none"> <li> <b>NOTE:</b> If a hot spare is present, the rebuild starts with the hot spare after the disk is removed.</li> </ul> </li> <li>3. Replace the disk with a new physical disk of equal or higher capacity.</li> <li>4. Perform the <b>Auto Replacement of a Virtual Disk</b> operation. <ul style="list-style-type: none"> <li> <b>NOTE:</b> The <b>Auto Replacement of Virtual Disk</b> operation allows you to copy data from a source physical disk of a virtual disk to a target physical disk that is not a part of the virtual disk. For more information about the <b>Auto Replacement</b> feature, see <a href="#">Auto Replacement Of A Virtual Disk Member And Revertible Hot Spares</a>.</li> </ul> </li> </ol>

## SMART Error Detected On A Physical Disk In A Non-Redundant Virtual Disk

- Issue:** A SMART error is detected on a physical disk in a non-redundant virtual disk.
- Corrective Action:** Perform the following steps:
1. Back up your data.
  2. Physically remove the physical disk that detected the SMART error.  
 **NOTE:** The virtual disk will be in a **Failed** state after the physical disk is removed. Ensure you back up your data before performing this operation.
  3. Replace the affected physical disk with a new physical disk of equal or higher capacity.
  4. Delete the failed virtual disk and recreate the virtual disk with the same members.  
 **NOTE:** For information on creating and deleting virtual disks, see the *Dell Chassis Management Controller for Dell PowerEdge VRTX User's Guide* at [dell.com/esmmanuals](http://dell.com/esmmanuals).
  5. Restore from the backup.

## Auto Replacement Member Errors

-  **NOTE:** For more information about the **Auto Replacement Member** feature, see [Auto Replacement Of A Virtual Disk Member And Revertible Hot Spares](#).

### Source Disk Fails

- Issue:** The source disk fails during the **Auto Replacement Member** operation.
- Description:** If the source data is available from other disks in the virtual disk, the rebuild begins automatically on the target disk, using the data from the other disks.

### Target Disk Fails

- Issue:** The target disk fails.
- Description:** If the target disk fails, the **Auto Replacement Member** operation is terminated.

### General Disk Fails


- Issue:** A general disk fails.
- Description:** If the target disk fails and the **Auto Replacement Member** operation terminates but the source data is still available, then the **Auto Replacement Member** operation continues as **Auto Replacement Member**.

## Hard-Drive Indicator Patterns



**Figure 2. Hard-Drive Indicators**

1. hard-drive activity indicator (green)
2. hard-drive status indicator (green and amber)

Drive-Status Indicator Pattern	Condition
Blinks green two times per second	Identifying drive or preparing for removal
Off	Drive ready for insertion or removal
	 <b>NOTE:</b> The drive status indicator remains off until all hard drives are initialized after the system is turned on. Drives are not ready for insertion or removal during this time.
Blinks green, amber, and off	Predicted drive failure
Blinks amber four times per second	Drive failed
Blinks green slowly	Drive rebuilding
Steady green	Drive online
Blinks green three seconds, amber three seconds, and off six seconds	Rebuild aborted

# Getting help

## Contacting Dell

Dell provides several online and telephone-based support and service options. If you do not have an active Internet connection, you can find contact information on your purchase invoice, packing slip, bill, or Dell product catalog. Availability varies by country and product, and some services may not be available in your area. To contact Dell for sales, technical support, or customer-service issues:

1. Go to **dell.com/support**.
2. Select your country from the drop-down menu on the bottom right corner of the page.
3. For customized support:
  - a. Enter your system Service Tag in the **Enter your Service Tag** field.
  - b. Click **Submit**.
4. For general support:
  - a. Select your product category.
  - b. Select your product segment.
  - c. Select your product.

The support page that lists the various support categories is displayed.

The support page that lists the various support categories is displayed.

## Locating your system Service Tag

Your system is identified by a unique Express Service Code and Service Tag number. The Express Service Code and Service Tag are found on the front of the system by pulling out the information tag. Alternatively, the information may be on a sticker on the chassis of the system. This information is used by Dell to route support calls to the appropriate personnel.

## Documentation feedback

If you have feedback for this document, write to **documentation\_feedback@dell.com**. Alternatively, you can click on the **Feedback** link in any of the Dell documentation pages, fill out the form, and click **Submit** to send your feedback.